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ENVIRONMENTAL IMPACT STATEMENT ON THE PROPOSED MONTANA POWER COMPANY ELECTRICAL GENERATING PLANT AT COLSTRIP, MONTANA

October, 1972

Department of Health and Environmental Sciences
John S. Anderson, M.D., Director
Environmental Sciences Division
Benjamin F. Wake, Administrator
Air Quality Bureau
Don Holtz, Chief

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ERRATA SHEET
FOR DRAFT ENVIRONMENTAL IMPACT STATEMENT

After Page 5, flow sheet should be titled Figure 1. Note that numbers given are for each unit, not both units.

Pages numbered 9 and 10, Tables 1 and 2, are stapled on the wrong side. Tables 1 and 2 belong between pages 11 and 12. These changes result in the following:

Page 11 becomes 9
Page 9 becomes 10
Page 10 becomes 11

On Page 19, Table 6 follows on the next page; Table 7 is in the Appendix.

Page	Line from Top	Change
Table of Contents		Sec. IV, Proposed should be Proposal
iv	Ownership	Venture Montana should be Venture-Montana
2	3	Condensor should be condenser
12	19	Plant or those should be plant on those
18	11	Seious should be serious
22	12	Probably should be probable
26	11	Should be comma after material
28	23	Aquatil should be aquatic
30	17	Impacts or present should be impacts of present
40	3	Boon or bone should be boon or bane
42		Map should be labelled Figure 2; also page number should be at bottom
43		Map should be labelled Figure 3; also page number should be at bottom
44		Table should be Table 7

JOHN S. ANDERSON, M D
XXXXXXXXXXX
Director

State of Montana

State Department of Health
AND ENVIRONMENTAL SCIENCES
HELENA, MONTANA 59601

November 9, 1972

EXTENSION OF TIME PERIOD FOR COMMENT ON DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE PROPOSED COLSTRIP POWER PLANT

As provided for in Section 7 of the Interim Guidelines for Environmental Impact Statements promulgated under the Montana Environmental Policy Act of 1971, the Air Quality Bureau of the Environmental Sciences Division hereby grants a 15-day extension for comments on the "Environmental Impact Statement on the Proposed Montana Power Company Electrical Generating Plant at Colstrip, Montana."

Because of delays in getting copies printed and the time in mailing that incurred after the October 13 filing date, the start of the 30-day period and the 15-day extension has been moved to October 25, thus making the final date for receiving comments December 9, 1972.

Sincerely,

Donald Holtz, Chief
Air Quality Bureau

date due
JUN 6 1990
NRIS

TABLE OF CONTENTS

Page
Forward i
Statement Summary ii
Summary of Statistics of Colstrip Plant iv

I. Description of Proposed Action 1
- A. General Description 1
  - 1. Plant and Process 1
  - 2. Pipeline and Water 2
  - 3. Transmission Lines 2
  - 4. Strip Mining and Coal Supply 3
  - 5. Construction and Location 3
- B. Detailed Description of Process 4

II. Environmental Setting of Proposed Power Plant 5
- A. Topography 5
- B. Population 7
- C. Land Use 7
- D. Historical Values 8
- E. Recreation 8
- F. Meteorology 8

III. Probable Impact on the Environment 11
- A. Emissions and Effects 11
  - 1. General 11
  - 2. Particulate 12
  - 3. Sulfur Oxides 14
  - 4. Nitrogen Oxides (NO_x) 17
  - 5. Trace Elements 18
  - 6. Effects of Water and Heat Emission from the Power Plant 20
  - 7. Effects on Visibility and Aesthetics 21
  - 8. Effects on Ecosystem 22
- B. Emission Control and Guarantees 23
- C. Plans by Applicant to Maintain Air Quality and Lessen Overall Impacts 23
- D. Impacts Other than Emissions 25
  - 1. Ash and Water Discharge to the Land 25
  - 2. Land Use 27
  - 3. Impact on Flora and Fauna 28
  - 4. Impact on the Human Environment 29
  - 5. Impact of the Proposal on the Senses 31
  - 6. Impact on the Community During Construction 32

IV. Adverse Environmental Effects which Cannot be Avoided Should the Proposed be Implemented 33

V. Alternatives to the Proposed Action 34
- A. Not to Construct 34
- B. Other Fossil Fuels: Oil and Gas 34
- C. Nuclear Fission Plants 34
- D. Nuclear Fusion Plants 34
- E. Hydro-electric 35
- F. Magnetohydrodynamics 35
- G. Solar Energy 35
- H. Geothermal 35
- I. Wind 35

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TABLE OF CONTENTS (Continued)

Page

VI. Relationship Between Local Short-Term Uses of Man's Environment and Long-Term Effects 37

VII. Irreversible and Irretrievable Commitments of Natural and Economic Resources 41

Appendix
- Map of Southeastern Montana Air Sampling Network 42
- Map of Colstrip Air Sampling Network 43
- Sampling Results 44
- Persons Writing Impact Statement 45

FORWARD

This draft Environmental Impact Statement is submitted pursuant to the Montana Environmental Quality Act, Section 69-6504 (b) (3). This statement is prepared by the Montana State Department of Health and Environmental Sciences, Environmental Sciences Division, regarding the proposed coal-fired electric generating facility to be constructed near Colstrip, Montana.

Comments should be submitted to the Air Quality Bureau, Montana State Department of Health and Environmental Sciences, Cogswell Building, Helena, Montana 59601, within 45 days, by Monday, November 27, 1972.

SUMMARY: DRAFT ENVIRONMENTAL IMPACT STATEMENT

Coal-Fired Steam Electric Plant, Colstrip, Montana
Prepared by Montana State Department of Health and Environmental Sciences
Environmental Sciences Division

1. TYPE OF ACTION: Administrative

2. DESCRIPTION OF ACTION:

The Montana Power Company and the Puget Sound Power and Light Company have made application for a Construction Permit to the Montana State Department of Health and Environmental Sciences, Environmental Sciences Division for a 700-megawatt coal-fired steam electric power generating plant to be located just east of Colstrip, Montana. The first unit is scheduled for completion in 1975 and the second in 1976. The Montana Environmental Policy Act required that an impact statement be submitted and evaluated prior to any major action, in this case the granting of a Permit to Construct.

The generating station will burn coal from an adjacent mine. The coal will be transported by truck from the mine to a crusher and from there to the plant by conveyer. Cooling water, boiler make-up water, and scrubber water will be transported by pipeline from the Yellowstone River, about 31 miles to the North. There will be no return to the river.

The companies propose to construct two additional transmission lines from Colstrip to the Billings area. Additional transmission line construction in both eastern and western Montana may result from existence of the proposed plant at Colstrip.

3. PROBABLE IMPACT OF THE PROPOSED ACTION ON THE ENVIRONMENT

Sulfur oxides, particulate, nitrogen oxides, trace elements, water vapor and heat will exhaust from two 500-foot stacks. Emission and ambient air levels will comply with all state and federal standards except in the case of ambient sulfur oxides, which will occasionally, under certain meteorological conditions and in spite of emission controls, exceed Montana's one-hour standard. Reduction of plant load when these meteorological conditions arise could prevent the high one-hour levels. Effects of pollutants, including fluorides, on flora and fauna, weather, and aesthetics appear minimal, although subtle long-term effects may be indeterminable.

Construction of the power plant, cooling systems, transmission lines, pipe line, and strip mine development impose primary and secondary impacts on the environment. These effects, in addition to those on flora and fauna, include aesthetics, the economy, society and others.

4. PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED, SHOULD THE PROPOSAL BE IMPLEMENTED

Some of the adverse effects include the consumption of a non-renewable resource, air quality degradation, disturbance of land by mining, and aesthetics.

5. ALTERNATIVES TO THE PROPOSED ACTION

Alternatives include: not building the plant, use of other fossil fuels or nuclear fuels, geothermal power, MHD, solar energy, and wind.

6. SHORT TERM BENEFITS VS. LONG TERM EFFECTS

The long-term adverse effects may well outweigh the short term gains.

7. IRREVERSIBLE AND IRRETRIEVABLE COMMITTMENTS OF NATURAL RESOURCES

The proposed plant will consume 90 million tons of coal over the 30-year life of the plant, or three million tons per year of this non-renewable resource.

SUMMARY OF STATISTICS OF COLSTRIP PLANT

Location	One mile east of Colstrip, Montana, 30 miles south of I-94, at Forsyth; Section 34, Township 2 North, Range 41 East, Rosebud County, Montana
Elevation	3200 feet above sea level
Ownership	Joint venture Montana Power Company and Puget Sound Power and Light Company
Operation	Montana Power Company
Scheduled Completion	Unit #1, July 1975; Unit #2, July, 1976.
Total Cost	$183,000,000
Steam Generator	Combustion Engineering Company
Capacity	2,520,000 lb steam/hr/unit
Size	206 feet high, 160 feet wide, 238 feet long
Turbines	General Electric
Capacity	350 MW/unit, 700 MW total (nominal)
Cooling Towers	Ecodyne Corporation Wet crossflow induced draft type 65 feet high, 48 feet wide, 252 feet long; 117,200 gal/min inlet water/unit
Stack	Two stacks--each 500 feet high, approximately 30 feet diameter at base
Scrubbers	
Type	Venturi with alkali chemical system
Capacity	1,600,000 cu. ft. per min. @ 293°F
Buildings	300 feet high, 160 feet wide, 238 feet long
Coal	385,000 #/hr; 8,843 BTU/#, 23.87% moisture, 0.77% sulfur, 8.59% ash
Mine	Strip-type, approximately 65 surface acres/year, 3,000,000 tons of coal/year
Transmission Lines	3 lines, 230 kV each, 60 feet high, 800 feet average span, 3 conductors, 2 shield wires per line
Pipeline	24" diameter, (minimum), approximately 30 miles
Water Consumption	8,000 gals per minute, 4.2 x 10^9 gal per year
Pond	30 surface acres, 100 acre feet

I. DESCRIPTION OF PROPOSED ACTION

I. DESCRIPTION OF PROPOSED ACTION

A. General Description

1. Plant and Process

The Montana Power Company and the Puget Sound Power and Light Company, in a joint venture, propose to construct a 700-megawatt (MW) power generating station near Colstrip, Montana. This complex, composed of two 350 MW units, will provide electricity for Montana users and for shipment to the load centers of the Pacific Northwest. The plant will burn coal, supplied from deposits in the immediate area of Colstrip. The first unit is scheduled for completion by July, 1975, and the second by July, 1976.

The proposed plant will be the third coal-fired steam electric generating facility and the first "mine-mouth" plant to be constructed in Montana. Montana Dakota Utilities 44 MW plant at Sidney (1958) and Montana Power's 180 MW Corette plant at Billings (1968) are small by comparison, and are considered load-oriented. "Mine-mouth" plants, which are located near enough to the coal for conveyor or short-distance rail transfer of coal, are presently favored by economic, technical, and environmental parameters, at least from the owners' standpoint. In earlier years, power plants were generally located near load centers and the coal imported over long distances.

Air pollution is considered by most to be the most serious environmental threat from coal-fired generating plants. Atmospheric emissions will be minimized by venturi scrubbers, a relatively new development in power plant emission control. Simplicity and control of gaseous emissions, as well as good particulate control, favor the wet scrubbers. Traditional electrostatic precipitators control only particulate matter. There is evidence that the venturis will also remove most fluorides and trace metal compounds. Atmospheric dispersion will be obtained by venting the cleaned flue gases to two 500-foot stacks.

Wet crossflow induced draft cooling towers will provide cooling for the plant water, preventing any thermal discharge to a stream. The cooling towers will receive hot water from the plant condensors and return cool water to condense steam from the turbines. Blowdown from both the cooling towers and the boiler will be discharged to the ash pond. Pond water will be recirculated to the venturi scrubbers in a closed loop system. Water will be discharged only to the atmosphere. Collected flyash from the scrubbers, bottom ash, and economizer ash from the boilers will be sluiced to the ash pond, and periodically removed and used as fill in worked-out strip mines. A network of ash ponds, designed for decanting and draining will aid in the ash disposal.

2. Pipeline and Water Supply

Plant water will be obtained from the Yellowstone River and supplied to the plant by a buried steel pipeline at least 24-inches in diameter. The pipeline will intercept the Yellowstone at Nichols and be routed up Armells Creek Valley to the plant site. It will carry a maximum of 8,000 gallons of water per minute to a 100 acre-feet surge pond. The pond, covering approximately 30 surface acres, will hold a three-day supply of water for the plant.

3. Transmission Lines

Electricity will be transferred by three 230 KV transmission lines, originating in the plant switchyard and extending westerly to the Billings area. One line, presently under construction, is routed south of the Yellowstone River Valley through Hardin to the Billings steam electric generating station. Two additional lines are scheduled for completion in mid-1975 and 1976. These two lines will share a common corridor where feasible, crossing the Yellowstone River Valley east of Billings at a location yet to be determined. They will terminate at a new substation to be added to the Montana Power Company's integrated system north of Billings. Each line will consist of three conductors and two shield wires supported by two vertical wooden poles with some three pole structures where required. The lines will be approximately 60 feet high with an average of 800 feet between poles.

4. Strip Mining and Coal Supply

Western Energy Corporation, a wholly owned subsidiary of Montana Power Company, will supply coal for the generating facility. Approximately 65 surface acres will be mined each year to supply the estimated consumption of three million tons of coal per year. Coal will be trucked from the mine pits to a crusher and taken by conveyor belt to the plant site stockpile. The Montana State Department of Lands will make intensive evaluations of the strip mining and reclamation necessary for this facility. Environmental impact statements will be written, as required by the Montana Environmental Policy Act of 1971. The Department of Lands also requires that permit applications be submitted, and these will be closely scrutinized.

The vast quantities of strippable coal in eastern Montana and the Fort Union Basin suggest further electrical energy development in the area. The North Central Power Study, funded and supported by the Bureau of Reclamation in collaboration with some 35 interested utilities, proposed development of up to 53,000 MW generating capacity in the Fort Union Region of southeastern Montana and northern Wyoming. The Montana Power Company and Puget Sound Power and Light Company are already considering additional units at the Colstrip location, possibly several times larger than the present proposed plant.

5. Construction and Location

The proposed plant will be located immediately east of the company town of Colstrip, about 30 miles south of Interstate 94 at Forsyth and about 100 cross country miles due east of Billings. Montana Power Company owns and has available 1365 acres for the plant site. This area will contain the two thermal electric generators, cooling towers, surge pond, ash pond, and a coal storage area.

Employment during construction will peak at 800-900 men. Following construction, approximately 44 persons will be required to operate Unit #1, and 19 more will be required for Unit #2. An additional 55 employees will be needed in the mining operation. Operating personnel and mining employees will probably be housed

in the company-owned town of Colstrip. The Ron R. White Company of Denver, land-use planners and designers, has been awarded a contract to develop a town plan. This town expansion plan provides primarily for long-term operating personnel and makes little provision for the 800-900 men required for plant construction. Construction crews will likely commute from distant towns, such as Forsyth and Billings.

The total cost of the proposed facility will be in excess of $183 million. The Bechtel Corporation, headquartered in San Francisco, is the engineer-contractor for the generating facility.

B. Detailed Description of Process

Figure 1 illustrates a material balance for the generating facility as submitted by the applicant.

Following is a more detailed process description, also submitted by the applicant:

> "Coal of approximately 1.5 inch lump size is transported to the plant storage site. It is mechanically conveyed into the plant and fed to coal pulverizers which reduce it in size from 1.5 inches to a size such that 70% of the coal will pass through a 200 mesh sieve. The pulverized coal is then used as combustion fuel for a steam generator. The coal is fed into the steam generator through fuel nozzles, which are located at the four corners of a furnace. The coal is mixed with air in the furnace and ignited. The combustion process gives off energy in the form of heat which is transferred through the furnace walls to water which is converted to steam at 2,400 lbs per sq. inch and 1,000°F. The steam is piped to a turbine which extracts energy by reducing the steam to a low pressure and temperature. The energy is used to rotate the shaft of an electric generator whose output is delivered to an electric transmission system exterior to the plant.
>
> The low pressure steam exhausted from the turbine is reconverted to water by cooling in a condenser, and then returned to the steam generator for reuse. The cooling is accomplished by supplying water at a lower temperature than the steam to the tube side of a shell and tube heat exchanger (condenser). The cooling water absorbs the heat of the condensing steam through the tube walls and is pumped to a cooling tower where it is exposed in the form of droplets to a flow of atmospheric air. The air evaporates some of the water causing the balance to be cooled so that it can be returned to the condenser for reuse. Fresh water to replace the amount that is evaporated is supplied to the cooling tower from the surge pond or pipeline.
>
> In the steam generator, the unused portions of the combustion air and the gaseous products of combustion are combined, and along with any suspended fly ash from the burned coal, are conveyed to a flue gas scrubbing system installed for emission control. This is a full stream scrubber system that will simultaneously remove fly ash and sulfur dioxide.

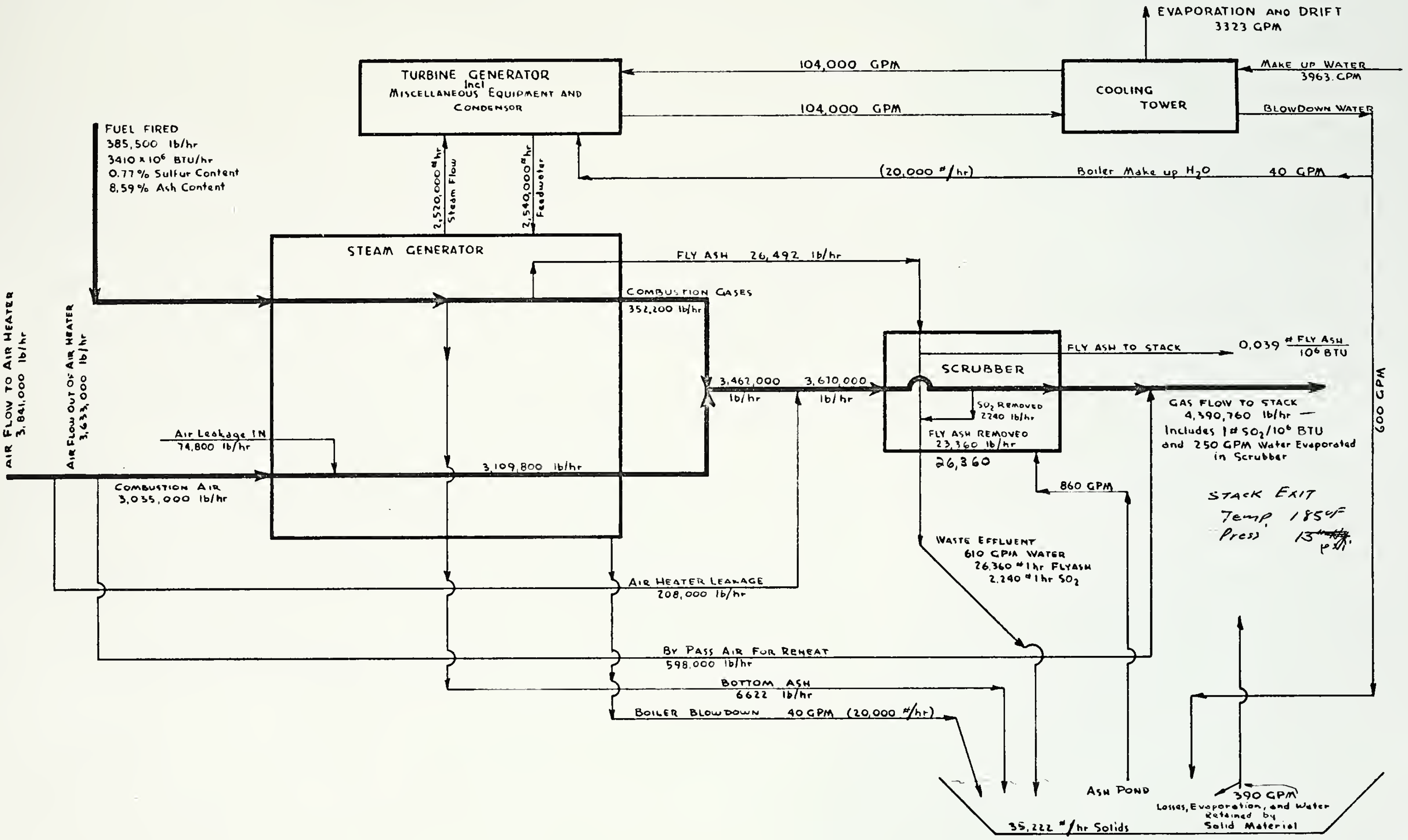
The removal is accomplished by scrubbing the flue gas with an alkaline solution of water and calcium carbonate, which is generally available from the fly ash. If the alkalinity of the ash varies to a point where additional alkalinity must be added, it is obtained by the addition of soda ash (Na_2CO_3) or lime (CaO). The gaseous sulfur dioxide will react with the calcium carbonate to form solid calcium or sodium salts. At the same time, the mechanical action of the scrubber traps fly ash particles in the water droplets. Recirculation within the scrubber system makes the alkalinity in the ash available for the process. The used scrubber solution, newly formed salts, and trapped fly ash are piped to an ash pond where the solids settle out. The pond water is then recirculated back to the scrubber in a closed loop system from which no water is discharged to any natural bodies. This emission control system is guaranteed to limit the sulfur oxide emissions to 1.0 lb SO_2/million BTU and the fly ash emissions to .018 grains per actual cubic foot, at any operational load of the power plant.

The coal charged into the process will have the following average composition:

Moisture	23.87%
Fixed Carbon	38.95
Volatile Matter	28.59
Ash	8.59
	100.00%
Sulfur	0.77% (included above)
Heating Value	8,843 BTU/lb

At full load, 385,500 lbs per hour of this fuel will be burned in each unit corresponding to 3,410 million BTU per hour of heat release per unit. The corresponding sulfur oxide production would be 5,650 lbs per hour SO_2 or 1.658 lbs SO_2 per million BTU input. The flyash production would be 26,492 lbs per hour, since 20% of the total input of 33,114 lbs per hour will become attached to the furnace walls and removed as boiler slag while the balance leaves the furnace as fly ash. This corresponds to 7.77 lbs of fly ash per million BTU.

The guarantees on the emission control systems are equivalent to 99.5% particulate removal and 39.7% SO_2 removal, which will limit particulate emissions to 0.039 lbs per million BTU input and sulfur oxide emissions to 1.0 lbs per million BTU input."


EVAPORATION AND DRIFT 3323 GPM
TURBINE GENERATOR Incl MISCELLANEOUS EQUIPMENT AND CONDENSOR
104,000 GPM
104,000 GPM
COOLING TOWER
MAKE UP WATER 3963. GPM
BLOWDOWN WATER
FUEL FIRED
385,500 lb/hr
3410 x 10^6 BTU/hr
0.77% Sulfur Content
8.59% Ash Content
2,520,000 #/hr Steam Flow
2,540,000 #/hr Feedwater
(20,000 #/hr)
Boiler Make up H2O
40 GPM
STEAM GENERATOR
FLY ASH 26,492 lb/hr
COMBUSTION GASES 352,200 lb/hr
AIR FLOW TO AIR HEATER 3,841,000 lb/hr
AIR FLOW OUT OF AIR HEATER 3,633,000 lb/hr
Air Leakage IN 74,800 lb/hr
3,109,800 lb/hr
COMBUSTION AIR 3,035,000 lb/hr
3,462,000 lb/hr
3,610,000 lb/hr
SCRUBBER
SO2 REMOVED 2240 lb/hr
FLY ASH REMOVED 23,360 lb/hr
26,360
FLY ASH TO STACK
0.039 # FLY ASH / 10^6 BTU
GAS FLOW TO STACK 4,390,760 lb/hr — Includes 1# SO2/10^6 BTU and 250 GPM Water Evaporated in Scrubber
600 GPM
860 GPM
STACK EXIT
Temp. 185°F
Press. 13 ~~[illegible]~~ psi
WASTE EFFLUENT
610 GPM WATER
26,360 #/hr FLYASH
2,240 #/hr SO2
AIR HEATER LEAKAGE 208,000 lb/hr
BY PASS AIR FOR REHEAT 598,000 lb/hr
BOTTOM ASH 6622 lb/hr
BOILER BLOWDOWN 40 GPM (20,000 #/hr)
ASH POND
390 GPM
Losses, Evaporation, and Water Retained by Solid Material
35,222 #/hr Solids

ITEM VII

FLOW DIAGRAM
TYPICAL FOR EACH UNIT

II. ENVIRONMENTAL SETTING OF PROPOSED POWER PLANT

II. ENVIRONMENTAL SETTING OF PROPOSED POWER PLANT

A. Topography

The power plant is located very close to the town of Colstrip, Rosebud County, in southeastern Montana. The site lies in the northern Great Plains province, east of the ranges that make up the Rocky Mountains, except for the Black Hills to the southeast in South Dakota. The topography is developed on essentially flat lying sediments of the Fort Union Formation which contains most of the coal in eastern Montana and adjacent states. Numerous sandstones and shales are associated with the coal seams.

The Fort Union Formation was laid down as the Rocky Mountains to the west were rising during the Paleocene Age, about 65 million years ago. The climate was much milder and wetter at that time and the streams carried the sediments from the mountains into the Fort Union Region. In this region, there existed large coal swamps, producing the many coal seams now found in southeastern Montana and adjacent states. Coal in the Colstrip area is ranked as sub-bituminous and is found in seams as thick as 50 feet. During erosion of the Fort Union Formation, coal seams were exposed at the surface where they sometimes ignited and started underground coal fires. Many areas in this region have a pink to red rock known as clinker, a direct result of underground fires.

The elevations in the vicinity of Colstrip range from less than 2900 feet (MSL) in the Rosebud Creek Valley about 12 miles east of Colstrip to over 4400 feet (MSL) as near as 20 miles to the south. The elevation of Colstrip itself is about 3200 feet (MSL). The topography exhibits a number of land forms which have been developed on the flat lying sediments of the Fort Union Formation. The rolling upland is dissected by the streams in the area, producing narrow valleys, buttes, and some fairly level land. The level areas are the well-developed flood plains of certain stream valleys.

Colstrip lies within the lower Yellowstone River drainage basin, on the East Fork of Armells Creek, which drains directly into the Yellowstone River. Rosebud

Creek also drains an area very close to Colstrip and flows from the southwest of Colstrip to the east and then north into the Yellowstone River. Other major tributaries of the Yellowstone in this area are Sarpy Creek, Tullock Creek, Bighorn River, Little Bighorn River, Tongue River and the Powder River further to the east. The Yellowstone River flows from west to east and is located about 30 miles north of Colstrip. There are numerous small streams in the area, most of which are intermittent, because of the infrequent and variable annual precipitation.

B. Population

The present population of Colstrip is 200. The population density in the area immediately surrounding Colstrip is very low, about one to two persons per square mile, mostly ranchers. The town of Lame Deer, population 130, is about 18 miles south of Colstrip and Forsyth, population 1900, is about 30 miles north of Colstrip in the Yellowstone Valley. Billings, with a population of nearly 80,000, is about 90 miles to the west of Colstrip. Miles City lies in the Yellowstone Valley about 50 miles to the northeast. The Tongue River Indian Reservation lies to the south of Colstrip.

C. Land Use

Ranching and other agrarian pursuits comprise the bulk of the land usage in the Colstrip area. The ranches are generally a combination of grazing and dry-land crop farming. The valley bottoms are warm enough to permit some tillaged and irrigated agriculture, with crops such as alfalfa hay, wheat, oats, and barley.

There are some forested areas in the vicinity--Custer National Forest lies to the southeast of Colstrip--and there is some lumbering done in this area, but the scale is small compared to the lumbering activity in the western part of Montana. Coal is presently being mined in two places near Colstrip--the Western Energy Mine at Colstrip and the Peabody Coal Mine a few miles south. In other areas, coal is being mined by the Decker Coal Company at Decker, about 60 miles to the south, and by Knife River Coal Company at Savage, about 150 miles to the northeast.

D. Historical Values

The Indians were the first inhabitants in southeast Montana and staged some violent battle efforts in defense of their territory. Custer's Last Stand and the Battle of the Rosebud are only two examples of the activity going on in the late 19th century in this area. The archeology of this area is not well known. This portion of Montana may contain a great wealth of historically significant archeological material.

E. Recreation

Southeastern Montana offers some excellent recreational opportunities. The Custer National Forest has a number of campgrounds used by local people and tourists. The Pronghorn antelope, mule deer, and whitetail deer provide big game hunting to residents and non-residents of Montana. Ring-necked pheasants can be found along the Yellowstone River Valley and Hungarian partridge, sage grouse, and sharptail grouse offer good upland bird hunting. Sport fishermen can find walleye, sauger, and northern pike in the various water courses, especially the Yellowstone River. Trout have been found in certain ponds near Colstrip, and there are reports that a paddlefish hatchery is developing in the Yellowstone River near Forsyth.

F. Meteorology

Southeastern Montana is in the mid-latitudes which has a prevailing westerly air flow aloft. The major east-west storm track across the U. S. passes through the center of the state. The climate is considered semiarid and, as a whole, has what may be termed a modified continental climate. Within the general climate type, topographic effects provide a wide range of temperature and precipitation patterns.

The winters are quite cold, with invasions of cold arctic air from the north being occasionally interrupted by storms from the Pacific Ocean. Spring and early summer are the wettest parts of the year, with the heaviest rains coming from storms involving moisture from the Gulf of Mexico, mostly in May and June. The combination of early-growing-season precipitation with rapid temperature warming in May and June followed by hot, dry summers has helped to produce a stable agricultural base in the arable section of southeastern Montana.

III. PROBABLE IMPACT ON THE ENVIRONMENT

TABLE 1

AMBIENT AIR QUALITY STANDARDS AND PROJECTED MAXIMUM CONCENTRATIONS

Pollutant	Montana Standard	EPA Standard	Proposed Plant (Two Contribution Units)
Particulate	75 ug/m^3 (Annual geometric mean)	60 ug/m^3 (Annual geo. mean)	0.1 ug/m^3 (Annual)*
	200 ug/m^3 (24 hr. max)	150 ug/m^3 (24 hr. max.)	2.0 ug/m^3 24 hr.*
Sulfur Dioxide	0.02 ppm (Annual Arith. Mean)	0.02 ppm (Annual Arith.mean)	0.001 ppm (Annual max.)*
	0.10 ppm (24 hr. average)[1]	0.10 ppm (24 hr. average)[2]	0.02 ppm (24 hr. max.)*
	---	0.50 ppm (3 hr. average)[2]	0.14 ppm (24 hr. max.)*
	0.25 ppm (1 hr. average)[3]	---	0.43 ppm (1 hr. max.)*
Nitrogen Oxides	---	0.05 ppm (Annual Arith. Mean)	0.001 ppm (Annual)*
Fluorides	1 PPB (24 hr. average)	---	0.06 PPB (24 hr. max.)* (Uncontrolled)

*Diffusion Modeling Results

[1] Not to be exceeded over 1% of the days in any 3-month period

[2] Not to be exceeded more than once a year

[3] Not to be exceeded for more than one hour in any four consecutive days

TABLE 2

EMISSION STANDARDS & ESTIMATED EMISSIONS

Substance	Montana Standard	EPA Standard	Proposed Plant (2 Units)
Particulate	0.154 lb/10^6 BTU input 1050 lb/hr	0.10 lb/10^6 BTU input 682 lb/hr	0.039 lb/10^6 BTU input 266 lb/hr
Sulfur Dioxide	1.0 lb of S/10^6 BTU input 13,640 lb/hr	1.2 lb of SO_2/10^6 BTU input 8160 lb/hr	1.0 lb of SO_2/10^6 BTU input 6820 lb/hr
Nitrogen Oxides	— —	0.7 lb/10^6 BTU input 4774 lb/hr	$<$0.7 lb/10^6 BTU input $<$4774 lb/hr
Fluorides	—	—	3.2 lb/hr (Uncontrolled)
Mercury	—	—	0.23 lb/hr (Uncontrolled)
Carbon Dioxide	—	—	1,454,000 lb/hr
H_2O	—	—	710,000 lb/hr

III. PROBABLE IMPACT ON THE ENVIRONMENT

A. Emissions and Effects

1. General

Of all the parameters, stack emission from the proposed power plant probably poses the greatest primary impact on the environment. Other aspects imposing primary impacts are cooling tower water vapor emission to the atmosphere, ash and water discharge into and onto the land and direct disturbance of the land from mining. These factors, and others, are investigated in varying degrees of detail in this section.

From the "Final Environmental Statement for the Jim Bridger Thermal Electric Generation Project submitted by the Bureau of Land Management," for the proposed plant in western Wyoming, the following questions were raised:

1. Will the plant comply with state and federal emission and air quality standards?
2. What will be the effects of emission even if the plant complies?
3. What guarantees are there that the equipment will function as designed, and who will monitor companies in operation to see that they carry out their plans?

These questions were developed from responses to the draft environmental impact statement on that project.

The State of Montana is required to enforce federal standards established by the Environmental Protection Agency where they are more stringent or more inclusive than state standards. For some pollutants, such as mercury, Montana has established no standards. Table 1 gives state and federal ambient air quality standards, and compares them with projected maximum concentrations for the Colstrip area. Particulate, SO_2 and trace metal emissions are functions of coal composition. The estimated emissions listed in Table 2 result from averaged, preliminary coal analyses for the general area, and are compared with state and federal emission standards.

Data for estimated emissions were supplied by the applicant, and projected concentrations are calculated from these figures using a simulation technique known as

diffusion modeling. This is explained more fully in the section dealing with sulfur dioxide.

Diffusion modeling indicates that only in rare cases will either state or federal ambient air standards be approached or exceeded. That these standards are considered adequate is confirmed by the following statement by the Administrator of the Environmental Protection Agency in establishing the national primary and secondary air quality standards:

> "National secondary ambient air quality standards are those which, in the judgment of the Administrator, based on air quality criteria, are requisite to protect the public welfare from any known or anticipated adverse effects associated with the presence of air pollutants in the ambient air."

Emissions from the proposed plant are expected to drift to the east. The relatively high (500 feet) stacks are expected to disperse over a wide area the emissions remaining after control equipment. No mixing is expected with other airsheds.

No other major emission source exists within a 100-mile radius of Colstrip; therefore, no additive effects are foreseen. The Southwest Energy Study, compiled by a Federal Task Force for the Four Corners Region, indicated:

> "No significant additive effects of the concentrations covered by one plant or those of another plant if they are separated by 100 KM or more."

Possible additive effects will be investigated in detail should additional plants be proposed for this region.

2. Particulate

Using data furnished by the applicant and quoted in Table 2, combined full load particulate emissions from both units of the plant will not exceed 267 pounds per hour (3.2 tons/day). Some increase in atmospheric particulate loading will result from the plant emissions, but these emission rates are well within both Montana emission regulations and EPA New Source Performance Standards. Control to this degree requires a 99.5% collection efficiency, removing 53,200 pounds per hour of particulate from the flue gases at full load.

To give perspective to the maximum emission rate of 267 pounds per hour from the Colstrip generating facility, it can be compared to Montana Power Company's Corette

Plant in Billings. The Corette plant, less than 1/3 the size, emits 426 pounds per hour under full load. The Colstrip operation will have a visible steam plume from the stack except under very warm dry atmospheric conditions.

Variable throat areas in the venturi-type scrubbers for emission control, will assure adequate contact of the particulate with the scrubbing solution for capture of the particulate. Efficiencies with this adjustable throat scrubber can be maintained under varying loads.

For an estimation of the particulate concentrations in the present Colstrip area, we consider sampling done by the State Air Quality Bureau. Early in April, 1972, a rural sampling site was chosen to define background ambient air values. This data for a location some nine miles east of Colstrip is presented for the period from April 6 to September 3, 1972, as follows:

TABLE 3

	Number of Samples	High Value	Low Value	Geometric Mean	Arithmetic Mean
Total Suspended Particulates (24-hr. average concentrations in ug/m^3)	23	191	3.7	22	35.5

The sampling site was essentially isolated from road and mining emissions dust. It is, however, significant that only a fraction of one year has so far been considered (the winter will certainly bring reduced total suspended particulate values). Of the above data, the significant value is 22 ug/m^3. For a whole year, it is estimated that the total suspended particulate value will be approximately 15 ug/m^3. The national secondary standard is 60 ug/m^3 which is four times the particulate background value predicted for the Colstrip area. To obtain more representative and complete data, the state is continuing its sampling in the immediate area.

Maximum ground level concentrations for various pollutants have been obtained from diffusion modeling estimates as presented in the following section on sulfur dioxide.

From modeling (Table 4) a 2 ug/m^3 plant contribution for a 24-hour average was estimated with adverse weather conditions. This value is very low compared to the national 24-hour secondary standard of 60 ug/m^3 for total suspended particulates. Considering the background value of 15 ug/m^3, the addition of the 2 ug/m^3 figure mentioned above results in a total estimate of 17 ug/m^3.

However, one must consider road dust, which will increase due to greater population and mobility of that population, construction, and plant and mining operations. It is anticipated then that an annual geometric mean for the area may approach 50-60 ug/m^3.

TABLE 4

MAXIMUM GROUND LEVEL CONCENTRATIONS FOR TWO 350 MEGAWATT UNITS

Period / Pollutants	10 min.	1 hour	3 hour	24 hour	Annual
Particulates (ug/m^3)	-	-	-	2.0	0.10*
Sulfur Oxides ppm	0.62	0.43	0.14	0.02	0.001*
Nitrogen Oxides ppm as NO_2	-	-	-	0.02	0.001*

*EPA Diffusion Model

3. Sulfur Oxides

Data submitted by the applicant and listed in Tables 1 and 2 specify that sulfur oxide emissions from the proposed Colstrip plant will not exceed 1 lb/million BTU input to the system. This totals 6820 lbs/hour for the two units (82 tons per day) representing emission control efficiency of approximately 39%. Coal analysis reveals an average of 0.77% sulfur-in-coal.

Montana regulations limit emissions to 1 lb of sulfur/million BTU input or the

equivalent of 2 lbs of sulfur dioxide/million BTU input. Federal New Source Performance Standards for Fossil Fuel-Fired Steam Generators limit sulfur dioxide emissions to less than 1.2 lbs/million BTU input.

The following paragraph, taken from the applicant's permit application, explains the proposed sulfur oxide control system at the plant:

> ". . .This is a full stream scrubber system that will simultaneously remove fly ash and sulfur dioxide. The removal is accomplished by scrubbing the flue gas with an alkaline solution of water and calcium carbonate, which is generally available from the fly ash. If the alkalinity of the ash varies to a point where additional alkalinity must be added, it is obtained by the addition of soda ash (Na_2CO_3) or lime (CaO). The gaseous sulfur dioxide will react with the calcium carbonate to form solid calcium or sodium salts. At the same time, the mechanical action of the scrubber traps fly ash particles in the water droplets. Recirculation within the scrubber system makes the alkalinity in the ash available for the process. The used scrubber solution, newly formed salts, and trapped fly ash are piped to an ash pond where the solids settle out. The pond water is then recirculated back to the scrubber in a closed loop system from which no water is discharged to any natural bodies. This emission control system is guaranteed to limit the sulfur oxide emissions to 1.0 lb SO_2/million BTU and the fly ash emissions to .018 grains per actual cubic foot, at any operational load of the power plant."

Background sulfur dioxide values have been gathered in the Colstrip area for a one-year period (September, 1971, - September, 1972). See Figures 2 and 3, Appendix, for maps of the sampling sites in the general area. The data were obtained from monthly sulfation plate data using the conversion factor (mg $SO_3/100cm^2$/day) X 0.035 = parts per million.

TABLE 5

Sulfur Dioxide (ppm)	
Number of Samples	54
Annual Arithmetic Mean	0.003 ppm

This arithmetic value of 0.003 ppm should be significant as an average background value for the Colstrip area at present. Continued sulfur dioxide monitoring will be carried out by the State Department of Health and Environmental Sciences.

Referring to Table 4, we again find conservative one-hour, three-hour, 24-hour, and annual estimated SO_2 concentrations. The state's annual SO_2 background value of 0.003 ppm is even higher than the annual value of 0.001 ppm estimated for us by the EPA. It is very possible that the annual average could be slightly in excess of 0.004 ppm. The Air Quality Bureau does expect violations of their one-hour standard of 0.25 ppm, and remote possibility for violations of the other standards.

A computer dispersion model was developed to predict downwind, ground level concentrations from the two power plant units at Colstrip. A dispersion model uses various meteorological and emission parameters to determine maximum downwind concentrations of a particular pollutant at a given set of conditions. This technique is approved by EPA. This model was used to estimate particulate, sulfur dioxide and nitrogen oxide concentrations. Preliminary results showed that the maximum ground level concentration under adverse conditions would occur during a fumigation situation and would occur at the stack base. However, at the nearest location immediately removed from company property (1.5 km away from the stack base) the SO_2 concentration may be expected to reach .43 parts per million for a one-hour period. Such concentrations would be in violation of the state one-hour standard if exceeded more frequently than one every four days. Other federal or state standards are not threatened by SO_2 emissions from the power plant facility. See Table 1.

A different model but similar in design and theory was used to estimate long term (annual) concentrations. The long-term modeling was performed by Environmental Protection Agency, Denver, Colorado. Their results listed in Table 4 indicated no violation of the annual standards with this estimate occurring more than 1.5 km from the stack base.

Estimates for oxides of nitrogen and particulate were made by multiplying the SO_2 results by the respective ratios of SO_2 emission to nitrogen oxide and particulate are also listed in Table 4.

As noted earlier by the computer modeling, results are preliminary since input meteorological parameters were not founded facts. As more representative meteorological data becomes available, further modeling will be performed.

The state's experience in ambient monitoring of other industrial complexes around the state suggests that one-hour SO_2 concentrations approximating one part per million do occasionally occur under adverse weather situations. The terrain surrounding Colstrip does not rule out wind channeling, impingement and other real-life phenomena which might cause similar higher SO_2 concentrations in the Colstrip area than the above diffusion predictions. A similar discussion could also be developed for other emission parameters.

4. Nitrogen Oxides (NO_x)

The boiler supplier for the proposed two unit plant guarantees nitrogen oxide leaving the units will not exceed .7 lbs NO_x/million BTU, the level specified in the Federal New Source Performance Standards. For the Colstrip plant operating at full load this totals 4750 lbs per hour of nitrogen oxides.

The following information was submitted by the Montana Power Company regarding NO_x emissions:

> "The steam generators at this installation will both be tangentially fired pulverized units.
>
> In order to insure an absolute minimum of nitrogen oxide formation, we have purchased an overfire air system as part of this equipment. This system takes the normal amount of combustion air and distributes it to a greater volume of the furnace than would normally be used in a tangentially fired unit. The greater distribution of combustion air reduces the maximum flame temperatures and the amount of nitrogen available for combination at any particular location in the flame. As a result, nitrogen oxide products will be substantially reduced below the low levels normally found on a tangentially fired unit.
>
> With the overfire air system, the supplier, Combustion Engineer, Inc., has guaranteed that the nitrogen oxides leaving the unit will not exceed .7 lbs/million BTU, which we understand is the current federal emission standard."

The state agency has done no background ambient sampling for nitrogen oxides. The EPA AP-84 publication "Air Quality Criteria for Nitrogen Oxides", page 3-1,

states that the non-urban North American continental average levels of NO_2 are about 0.004 ppm. The source of this background NO_2 is biologically produced NO which under photochemical oxidation yields the NO_2 variety.

Extrapolation of the SO_2 dispersion model resulted in low concentrations of nitrogen dioxide. It appears that there should be little problem with ambient NO_2 concentrations.

5. Trace Elements

Very little is known about the trace element content of the coal to be burned at Colstrip. Thorough, comprehensive sampling for trace elements has not been done on this coal. Mercury and fluorine have been the trace elements given the most attention, but others may prove to be seious pollutants, especially radioactive ones.

Even though trace elements exist in concentrations from several ppm to less than one part per million, when millions of tons of coal are burned the trace elements become significant potential pollutants. The proposed Colstrip plant will consume about three million tons of coal per year.

Mercury

Values of mercury in the coal range from .006 ppm to 0.7 ppm for the Rosebud seam. An average of 19 samples analyzed by Truesdale Laboratories was less than 0.1 ppm. Other analyses indicate an average nearer 0.3 ppm to be the average concentration of mercury in the Rosebud seam. Concentrations as high as 6.25 ppm Hg have been found in the pyrite in the coal. The efficiency of the venturi scrubber to remove mercury vapor is unknown.

Fluorine

Concentrations of less than 1.0 ppm to 12.5 ppm F have been found by Truesdale Labs in 19 samples. The average for these 19 samples was somewhat greater than 4.2 ppm.

Assuming 4.2 ppm F in the coal and if all is emitted into the atmosphere, about 77 pounds will be released per day. By comparison, the Anaconda Aluminum Plant in

Columbia Falls emitted 2500 pounds per day causing extensive damage to vegetation. The allowable fluoride emission from this plant is 864 lbs per day. This amount is expected to minimize the amount of damage to the vegetation. The potential for damage to the ecosystem by fluorides from the proposed Colstrip plant is not known at this time. At 77 pounds per day, more than 800,000 pounds may be emitted over the 30-year life of the plant which may be a more significant fugure than the daily rate. However, it is expected that a large but unknown percentage of the fluorides will be removed by the venturi scrubber.

Radioactive Substances

From some samples obtained in June, 1972, at the Western Energy Mine, the following values were measured:

Radium: 2.8 pCi/g
Uranium: 0.7 and 0.77 ppm
Thorium: 3 and 1.74 ppm

There may be other radioactive elements of greater concern due to the removal of uranium and thorium from the effluent gases. Although there will be a quantity of radioactive elements entering the environment from the proposed plant, the radiation is not expected to be in excess of any standards. Testing for radiation will be conducted if and when the plant begins operations.

Some baseline data investigations on trace element concentrations in the air around Colstrip are underway. This sampling began September 18, 1971, and has been expanded since then. Figures 2 and 3, Appendix, give the locations of sampling stations. Tables 6 and 7 are summaries of the data obtained from this sampling.

TABLE 6

Hi-vol analyses at a site 9 miles east of Colstrip are as follows:

Values are 24-hour averages in ug/m^3	No. Samples	High Value	Low Value	Geometric Mean	Arithmetic Mean
Total suspended particulate	23	191	3.7	22	--
Cadmium	20	0.001	0.000	--	0.0002
Lead	20	0.011	0.000	--	0.065
Zinc	20	0.290	0.010	---	0.1235

The above heavy metal data were obtained by chemical analyses of the hi-vol fiber-glass filters.

6. Effects of Water and Heat Emission from the Power Plant

From data submitted by the applicant, the proposed two-unit plant will emit 89,200,000 calories/second (1,274,000,000 BTU/hr) of heat and 88,000 grams/second (approximately 700,000 #/hr) of water from the two stacks. The analysis of the heat effects and H_2O concentrations downwind is parallel to that for SO_2. One may extrapolate concentrations of SO_2 to obtain similar results for heat and water. Ground level concentrations of water and effects of heat emissions would be lessened by their buoyant tendencies.

The likelihood of increasing downwind temperatures seems quite remote, but it is possible that the convective changes resulting from heat and water emissions will result in a greater precipitation potential, both in frequency and amount. The magnitude of the possible changes in precipitation is difficult to assess due to the limited state-of-the-art and complexities of the varying meteorological parameters.

The cooling towers are the largest single source of water emission. Combined output from the two units will be approximately 3,300,000 pounds per hour. As the towers are considered a low level source, their effects may be considerably more noticeable than H_2O from the stack.

7. Effects on Visibility and Aesthetics

Fine particulate, sulfur oxides, and nitrogen oxides released into the atmosphere from fuel combustion generally tend to reduce visibility and affect aesthetic quality. Particulates are considered the main culprit in visibility reduction and aesthetics, but their effect here will be minimized due to the low emission rate resulting from the 99.5% control efficiency. Following are some paragraphs on visibility reduction as reported in the First Annual Report of the Council on Environmental Quality.

> ". . .Particulates, however, are the major villain in reducing visibility. Particles (ash, carbon, dust, and liquid particles) discharged directly to the air scatter and absorb light, reducing the contrast between objects and their backgrounds. Particles are also formed in the atmosphere by photochemical reactions and by the conversion of sulfur dioxide to sulfuric acid mist. Wherever sulfur pollution is significant--which is wherever large amounts of coal and oil are burned--visibility diminishes as relative humidity rises.
>
> "The DHEW publication 'Air Quality Criteria for Particulate Matter,' 5/ states under the conditions set forth in the studies referenced therein that: '. . .With a typical rural concentration, such as 30 ug/m^3, the visibility is about 25 miles; for common urban concentrations, such as 100 ug/m^3 and 200 ug/m^3, the visibility would be 7.5 miles and 3.75 miles, respectively.'
>
> "With respect to sulfur dioxide concentrations, the DHEW publication 'Air Quality Criteria for Sulfur Oxides' states that "Visibility reduction to about 5 miles was observed at 285 ug/m^3 (0.10 ppm). However, this does not appear to be a typical case. ."

The phenomena of the last paragraph above would be rare in the Colstrip region because of the relatively low humidity as compared with other areas of the country. It is well established that high humidity combined with sulfur oxide in the atmosphere contributes to visibility reduction.

There is also a possibility that visibility may be reduced through chemical conversion of gaseous SO_2 and NO_2 to particulate sulfate and nitrate particles. The following information was taken from the Southwest Energy Study:

> "A review of available information on conversion of SO_2 and NO_x to particulate matter in plumes indicates that there is no information on conversion of NO_x to nitrate and the information on conversion of SO_2 is not very reliable and is in quantitative disagreement. However, it is clear from chemical analysis of collected particulate matter that SO_2 and NO_x are converted to particulate sulfate and nitrate.

> "If there is significant conversion of SO_2 and NO_x to particulates this will predominate over fly ash in causing visibility reductions."
>
> "Aircraft studies in power plant plumes have reported that as much as 50% of the gaseous SO_2 disappears (presumably to particulate sulfate or sulfuric acid) within ¼ mile of the stack exit." 8/

The relatively low emission rate of all pollutants from the proposed Colstrip plant seems to preclude a serious problem of visibility reduction. From an aesthetic standpoint, a visible steam plume will be evident from the stacks that will vary in size depending on temperature and humidity. Comparisons of this proposed plant with the #4 boiler at Pacific Power and Light's Dave Johnson Plant in Wyoming, (a similar unit already constructed and operating) indicates very little visible particulate emission after dissipation of the steam plume. It is probably that, under meteorological conditions such as high humidity, a marked increase in fog occurrences will be observed due to the water emission.

8. Effects on Ecosystem

The effects of pollution are often reflected by changes in the ecosystem before they are visible elsewhere. Plants and animals are adapted to the physical and living elements in their environment. A natural ecosystem contains species that have adapted to that particular environment and exist there because of the environment, not in spite of it. The addition of foreign substances into the ecosystem produce changes in the environment. These substances are pollutants and their presence creates stress in the ecosystem. Some species may not be able to withstand the stress and will be removed from the system. Some species may be favored by the absence of others. What the long range effects of SO_2, NO_x, fluorides, mercury, and other emissions from the proposed plant will be is impossible to predict at this time. Providing emission standards are met, there should not be a rapid change or deterioration of the flora and fauna, but over a period of years, the pollutants may build up to levels that seriously disrupt the ecosystem. Some desireable species may be replaced by less desireable ones, or if the stress becomes great enough, may reduce all species. A quantitative estimate of these effects is impossible at this point in time, given our present understanding of the fate of the pollutants in the ecosystem.

B. Emission Control and Guarantees

The permit application submitted by Montana Power Company and Puget Sound Power and Light Company states:

> "This emission control system is guaranteed to limit the sulfur oxide emissions to 1.0 lb SO_2/million BTU and the fly ash emissions to .018 grains per actual cubic foot, at any operational load."

> "The guarantees on the emission control systems are equivalent to 99.5% particulate removal and 39.7% SO_2 removal, which will limit particulate emissions to 0.039 lbs per million BTU input and sulfur oxide emissions to 1.0 lbs per million BTU input."

From these statements, the following questions are raised:

1. Will this control equipment continue to operate as efficiently after wear and corrosion?
2. What about buildup in the scrubber and piping system of flyash and the resulting product of flyash and SO_2?

To answer the first question, the equipment will be designed with protective coatings, or else constructed of corrosion free material, to minimize wear and corrosion. The operators of the plant will make frequent routine inspections for excessive wear and corrosion, and once each year the plant will be shut down for a thorough going-over and repair.

The problem of plugging and fan imbalances from flyash and flyash and sulfur oxide combinations is recognized. The few recently constructed power stations now equipped with scrubbers are experiencing these problems and investigating possible solutions. Normally each boiler unit has at least three scrubber units and as problems arise in a scrubber, the scrubber is dampered off and the boiler load reduced accordingly. The deposits are removed and the scrubber returned to the system. The U. S. Environmental Protection Agency, in justifying their New Source Performance Standards, and the electric power industry, seem confident that scrubber systems are inherently workable and that these problems can be met by design or process change.

C. Plans by Applicant to Maintain Air Quality and Lessen Overall Impacts

The applicant has indicated they will follow requirements of the Environmental Protection Agency by installing in-stack continuous monitoring equipment for particulates,

sulfur oxide and nitrogen oxides. In addition, test ports will be placed in the stack and breaching for source monitoring by the company and state and federal agencies.

The applicant's efforts to assess and minimize the environmental impact are explained in the following paragraphs taken from the "Environmental Impact Analysis" submitted by the applicant:

"Special Environmental Studies"

Studies under way to assess the environmental impact of the generating station include:

1. Archaeological survey by the University of Montana, Missoula, Montana.

2. Study by Montana State University (Bozeman, Montana) of air pollution effects on native vegetation, animals, soils in the vicinity of the Colstrip generating station.

3. Meteorological data collection and climatological interpretation of local weather patterns by MSU, Bozeman, Montana.

4. Mechanical air quality monitoring stations checking particulate, sulfur, fluoride, and NO_x by Montana Power Company.

5. Town planning for Colstrip growth by Ken R. White, land use planners and designers, Denver, Colorado.

6. Wildlife habitat utilization in the vicinity of the generating station by Ecological Consulting Service, Helena, Montana.

7. Determination of the presence of trace elements in coal, and their disposition through combustion with West Associates.

Participants Environmental Policy

The participants proclaim an environmental policy consistent with their contractual obligations and state and federal laws. The policy statement is as follows:

> 'It is the intent of the Montana Power Company and Puget Sound Power and Light Company to make the Colstrip project an asset to the community of Colstrip, the State of Montana, and the United States of America, by designing features for the station which will insure environmental protection. In conducting and operating the project, the participants will:
>
> 1. Conduct those studies necessary to obtain a complete understanding of how any new facility or activity may affect the environment and take appropriate action to protect the environment.
>
> 2. Inspect and survey all new facilities sites so that any historic or archaeological materials or any endangered species can be saved for posterity.

3. Install the necessary air and water pollution control equipment at our facilities so that emissions and effluents will meet or be less than established limits.

4. Construct generating stations in a manner which assures that stack effluents, however small, will be adequately dispersed.

5. Provide protection against pollution by dust.

6. Build into the project appropriate facilities for noise abatement.

7. Design and landscape all new facilities so that they will be harmonious with the surrounding area.

8. Work harmoniously with all local, state, and federal agencies and groups responsible for the protection of our environment.'

D. Impacts Other Than Emissions

1. Ash and Water Discharge to the Land

a. Dust from Ash

Fly ash, bottom ash, and ash collected in the economizer are sluiced to the ash pond system for settling. When the settled ash fills an individual pond to capacity, the water is drained off to another pond in the system and the ash is removed and used as fill in the strip mines.

The two possible sources of dust from this operation appear to be of only minor impact. First, dust may be generated from the surface of a dry inactive pond prior to or after ash removal. Secondly, dust may result from ash handling and disposal.

The applicant has indicated they will take care to keep ponds flooded at all times, especially if it appears a dust problem may arise. The applicant has also indicated they will take measures to reduce dust from ash handling. Data on physical properties of the ash indicate that the ash does not easily become airborne. This is especially true at the pond where it has a tendency to form a hard crust.

b. Water Contamination - Leaching of Ash

Preliminary analysis indicates no significant contamination of groundwater from the leaching of ash placed in the mines. The ash is relatively insoluble. However, this will be further investigated by both the applicant and the State Department of Health and Environmental Sciences. The applicant has indicated that they will selectively landfill the ash if groundwater purity is threatened.

c. Water Contamination - Plant

The closed recycling water system prevents any wastewater discharge to groundwater or streams. All water leaving the plant is discharged directly to the atmosphere from the stack, cooling towers, and ponds. Approximately 6250 gallons per minute of water evaporates from the cooling tower-condensor system, and 500 gallons per minute leave the stack.

Blowdown, consisting of mineral laden water from the boiler-turbine system, and from the condensor-cooling tower system, discharges to the ash pond. The minerals eventually are concentrated by evaporation and precipitate out in the pond.

d. Water Contamination - Colstrip Sewage System

An Imhoff Tank, which provides settling and removal of suspended material is presently used for sewage treatment. On May 8, 1971, the Montana Water Pollution Control Council adopted the following compliance plan for the community of Colstrip:

Begin construction of new sewage treatment facilities by September 1, 1971.

Complete construction of new sewage treatment facilities by January 1, 1972.

Plans and specifications were received for the project during April, 1971, and after requested changes were made, they were approved on October 14, 1971. A county rural improvement district was formally established for the project during October, 1971. Construction of the sewage lagoons began during September, 1972, and should be completed by January 1, 1973. Design of the facility was based on a projected 1990 population of 880.

Because there is essentially no flow in Armells Creek, it is necessary to have a facility which will provide removal of essentially all waste materials contributed by the population or to provide a facility which is capable of treating the sewage adequately, holding it to a time when there is adequate dilution flow in Armells Creek, and discharging it at that time. The latter method was chosen because of simplicity of operation and costs. It may also be possible to discharge the treated water to the Montana Power Company cooling water ponds when they are constructed. It is doubtful

that there will be any discharge from the sewage lagoons for several years. Aeration equipment can be easily added to the lagoons if an odor problem arises or if additional treatment is required.

A more detailed discussion of sewage disposal is presented in "Water Quality Management Interim Plan for Colstrip, Montana" prepared by the Montana State Department of Health and Environmental Sciences.

2. Land Use

The construction of the proposed power plant with its associated aqueduct, transmission lines, roads, mine and so forth, represents a major change of land use. The agrarian and wildlife uses of thousands of acres will be converted into industrial use.

The plant, as proposed, will occupy an area of 1365 acres. The mine will disturb an area of approximately 2000 acres over 30 years. The aqueduct and transmission line will temporarily alter approximately 2900 acres. However, most of the area involved in the aqueduct and transmission line rights-of-way will not be out of production. Roads along these rights-of-way may permanently change the land use of about 200 acres.

The greatest land use changes may not come from the proposed activities directly, but from the greater numbers of people in the vicinity. The increased population, especially during construction, will possibly result in trailer parks, subdivisions, drive-in businesses, service stations, and many other features that will alter land use. The growth of the town of Colstrip is being planned but it will certainly grow in area which will alter land use.

No judgment is attempted as to which land use changes are good and which are bad. A piece of land, presently habitat for a game species, that is converted to a golf course would undergo a major change in use. Whether this change is good or bad depends upon whether you are a golfer or a hunter. However, other changes may alter the land use outside of the immediately affected area. If the power plant emissions foul the air and water to such an extent that the recreational use of a large area is destroyed, or if large areas are not suitable for livestock raising or human habitation, many

persons might conclude that the land use changes are bad. There are no absolutes to be relied upon in this area. The question of land use changes in the Colstrip area is, "Should some or all of this area come under industrial use?" Parts of society wish this change to come about and parts are not concerned. Some persons do not want to see any industrialization in eastern Montana. Without an expression of concern from the persons interested in maintaining some of the present land use in eastern Montana, the proposed Colstrip plant may be only the first of many industrial developments that could conceivably alter the land use of most of the Fort Union Region. Very extensive land use changes have taken place in other parts of the U. S., such as southern California, New York, and New Jersey. Given the great potential of U. S. industry to alter great areas in short time, the few thousand acres involved in the proposed Colstrip plant may be relatively insignificant in one or two decades.

3. Impact on Flora and Fauna

The construction of the proposed plant, the mine, stack emissions, and the general increase in human activity will affect the flora and fauna. The effects would be produced in the following ways:

1. Occupation of land by other than natural habitat.
2. Presence of man-made structures.
3. Increased noise, pollution, and other factors affecting the functioning of the ecosystem.
4. Increased activity of man, including greater hunting pressure by the increased population.
5. Effects on aquatil systems by changes in quality and quantity of water.

All else being equal, the productivity of a region depends upon the amount of land area in production. The land that once supported plants that fed deer, mice, birds, and so forth, but will be used for the plant site, storage areas, settling ponds, roads, mining, and so on, will no longer support the living organisms. Therefore, the simple destruction of habitat for other uses will decrease the biota.

The presence of man-made structures directly affects the flora and fauna. Especially to birds, these structures, including transmission lines, are physical hazards that may

increase mortality rates significantly. The structures may also provide nesting sites or other accommodations for some species such as the common pigeon. The overall effect of the structures on the native species will probably be to reduce the numbers of individuals in the area.

The noise and pollution from the proposed facility will alter the ecosystem which will appear as effects upon the flora and fauna. The emissions from the plant will put a stress on some plants which may kill them or reduce their ability to compete with other species. Certain plants may be completely replaced. If such plants are essential to the survival of some animal species, a very significant change in community structure could take place. Likewise, certain pollutants may be very toxic to some species or may interfere with their reproduction, again leading to a major change in community structure. Some other species may be favored by these changes.

The increased activity of vehicular traffic, hikers, hunters, dogs, and so on will have a damaging effect upon the flora and fauna in most cases. Greater numbers of people living and working in the Colstrip area will increase the amount of contact between man and the natural ecosystem. This increased activity will be a direct result of the proposed power plant.

The aquatic ecosystems in the area, including the Yellowstone River, will be altered in a number of ways. The diversion of water for the proposed plant will decrease the flow in the Yellowstone. The water quality will also be changed as stack emissions get into the water and as towns increase in size producing more sewage, and urban-type runoff. It is impossible to quantify these changes or predict the major changes in such activities as sport fishing.

In conclusion, the proposed power plant will disrupt the natural ecosystem by decreasing its productive area, by promoting changes in the community structure, and by subjecting it to unnatural stresses.

4. Impact on the Human Environment

The human environment is formed by the cultural environment, the socio-political system, the economy, communication and transportation systems and their interactions

with each other. Essentially, the human environment is everything that affects the way we live.

Implementation of this proposal will alter the present life style in the area. The present agricultural economy will be partially displaced and superceded by an industrial system. The tax base will shift from productive land to capital investments. The increase in the industrial work force will lessen the relative importance of agricultural occupations, and require more and better educational facilities, transportation systems, communications systems, and a host of other private and public auxiliary services. One has only to look at other parts of the U. S. to perceive the effects of unplanned or poorly planned development in a rural-agrarian area.

Coal is a non-renewable resource, and when it is depleted, the entire system developed in the area will feel the effects for years to come. Careful and detailed planning of the project, if it is implemented, can minimize the adverse effects and maximize the positive results, at least as far as the economy is concerned.

Such planning for impacts on the cultural and socio-political systems is a problem of a different magnitude from that of power plant planning. Certain predictive techniques exist for evaluating future impacts or present actions upon society, but a conclusion drawn by one technique is usually as valid (or invalid) as another. The temptation is great to look upon the great power centers of the East and postulate numerous dire consequences of similar development. Critics can easily charge that the situations are not analagous; development of industrialized society in the East took place many years ago, in a different type of society, bereft of the information available today.

In fact, such criticisms are true, but no one can say that the results will not be worse than those encountered 20 or 50 years ago. The transformations experienced by modern man are so rapid that one has difficulty comprehending them, much less predicting and evaluating future modifications. Traditionally, agrestic life styles have been slow paced and relatively simplistic, whereas existence in an industrial society is characterized by a hectic, rapid pace complicated by such necessities as the social graces and who gets a key to the washroom.

On the gross scale, construction and operation of the power generating complex at Colstrip will have little distinguishable impact. In Colstrip, the more subtle effects will not be noticed for some time. Immediate impacts will be an increase in population, a fresh influx of money and a higher throughput of goods and services. We may or may not see increases in crime rates, welfare rolls, congestion, litter, and the other social and psychological evils associated with a high pressure society. However, these effects are seen as certain social conditions build up over years and decades. It is extremely likely that long before the ill social effects develop in eastern Montana, many more mines and conversion plants will be in operation. At that time, it will be impossible to separate the effects of the proposed Colstrip plant upon the society from similar development.

Careful, thoughtful planning can do much to alleviate the ill effects associated with coal development. That some of this planning is taking place is evidenced by Montana Power's hiring of a planning firm for the development of Colstrip. However, to do an effective job in social planning, if possible at all, would require a much greater investment of capital and energy than the planning for the power plant itself. Certain effects can be mitigated by planning but the basic economic pitfalls in an exploitive industry cannot be avoided. These pitfalls will become a part of the social environment if the proposed power plant and associated industry is permitted to become a reality.

5. Impact of the Proposal on the Senses

Impacts on the senses include impacts on sight, hearing, smell, taste, and touch. Taste, touch, and smell will not be affected to any noticeable degree by the varied aspects of the proposed plant and its ancillary structures. Construction and operating of the facility will have definite effects on sight and hearing.

The generating facility, the transmission lines, pipelines, and related strip mining will have certain impacts on the visual appearance of the area. The steam electric generating facility will consist of two 500-foot stacks, a structure 300 feet

high to house the boilers, coal storage area, and coal pulverizer. To some people, these structures are a sign of progress, and are considered things of beauty. Others consider them as insignificant, and some feel that such structures are a blight on the landscape. Much the same can be said for the transmission lines. The visual impact of the lines will be less in any single location, as they are spread over a larger area, whereas the impact of the plant will be restricted to the area from which it is visible. Aesthetic impacts of the pipeline will be limited to the construction period and to a service road. A service road will also be required for transmission lines. Although both roads will probably cross some presently roadless areas, the visual impact will be negligible as they will be less noticeable than many country access roads.

Noise levels in the area will be altered, peaking during the construction period, and diminishing when the plant becomes operational. Quantitative values are meaningless, as proximity to the source and frequency of sound are varied. The familiar sounds of ongoing construction will be encountered, such as vehicular noise and that emanating from welding machines, saws, and hammering. After construction has ceased, noise levels will be reduced, but not to the levels experienced prior to construction. Noise will be generated by coal trucks, plant operations, increased vehicular activity, increased population and the hum of the transmission lines.

6. Impact on the Community During Construction

Construction of the generating facility and its associated projects will likely cause a temporary population increase in Colstrip and the surrounding community. Haphazard trailer parks and temporary unplanned residential and commercial development could negatively affect:

1. Air quality, by dust from possibly unpaved roads and smoke from burning refuse.
2. Water quality and sanitation, by improper sewage and solid waste disposal.
3. Aesthetics
4. Economic and social parameters

IV. ADVERSE ENVIRONMENTAL EFFECT WHICH CANNOT BE AVOIDED SHOULD THE PROPOSED BE IMPLEMENTED

IV. ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSED BE IMPLEMENTED

There are a number of basic operations and effects that are inherent in a coal-fired power plant of the kind proposed. The impacts and effects of these operations and effects cannot be avoided. The following group of effects is considered unavoidable, should the plant be built:

1. The consumption of about 90 million tons of coal in 30 years.
2. The consumption of 4.2×10^9 gallons of water per year.
3. Some air pollution--the amount of pollutants can be reduced, but not to zero.
4. Occupation of land by plant, mine, aqueduct, transmission lines, and human habitation space.
5. Increased population in Colstrip vicinity.
6. Increased flow of capital and goods in vicinity of plant.
7. Change of life styles and social values as society is transformed from agrarian to industrial.
8. Aesthetic impact of facilities.

V. ALTERNATIVES TO THE PROPOSED ACTION

V. ALTERNATIVES TO THE PROPOSED ACTION

A. Not to Construct

The most obvious alternative would be not to construct the proposed generating facility. Many persons hold opposing views concerning the necessity of society's increasing power "demand" and the resulting imposition of additional generating facilities on our environment. The section of this report entitled "Relationship Between Local Short-Term Uses of Man's Environment and Long-Term Effects" discusses these views.

B. Other Fossil Fuels: Oil and Gas

Oil and/or natural gas could serve as fuel for the thermal-electric plant except that the fuels are in short supply, especially natural gas. Residual fuel oil, which is high in sulfur content, is limited in supply and also would contribute to sulfur oxide and trace element emission. Light oil is in even shorter supply and is expensive, as is natural gas.

C. Nuclear Fission Plants

Conventional fission plants consume an expensive nuclear fuel, a fuel the existence of which is finite. Also, energy required to process this fuel for power plant use likely contributes, at another location, to environmental degradation. Fission plants require vast quantities of cooling water and occasionally emit small amounts of radioactive material. Accidents which release large amounts of radioactive materials are a remote possibility. The disposal of radioactive waste from the plants is a problem. Short-term economics seem to favor coal fuel over nuclear fuels.

Fast breeder reactors, which theoretically require only small amounts of make up fuel, hold promise of economical operation but are not yet developed for commercial use. Waste disposal costs would be reduced. These plants would still require large amounts of cooling water.

D. Nuclear Fusion Plants

To date, science has produced only minimal breakthroughs in these developments, and commercial use could barely be expected in this century.

E. Hydro-electric

Feasibility studies indicate hydro-electric power could not supply the needed electricity. For the remaining suitable hydro-electric sites in Montana, it seems the environmental problem and other negative aspects would offset the positive assets.

F. Magnetohydrodynamics

This efficient method of electrical generation from coal remains to be commercially developed. The extreme costs seem to limit its use.

G. Solar Energy

Solar energy, as a source of electric power, is in the research stage at this time. However, little money to date is available to pursue this type of research. Solar energy represents the cleanest type of energy which might be used, although large tracts of land may be taken up in order to pursue a project of the Colstrip magnitude. Although solar energy has been talked about for many years, little has been done toward achieving any workable solutions. It may well be that future generations will find it necessary to use the millions of kilowatts of energy which fall on the earth each day. Even if solar energy could be converted into usable electric power, the cost would be prohibitive according to research now being done.

H. Geothermal

Geothermal sources of energy represent an unknown at the present. The true potential of geothermal energy in the Northwest is undetermined. Exploration along this line has been meager and the techniques for its use have not been worked out.

I. Wind

Power from wind seems at first hand to have several advantages over fossil fuel energy, including non-depletion of a resource, no fuel cost, and no pollution. Even so, utility companies have shown little interest. Inconsistencies in velocities nad occurrence of wind are major drawbacks. Because of these, any wind generating system must contain in it a large energy storage facility or be backed up by an adequate power source such as a fossil fueled steam plant. Present economics likely would not justify

investment in a steam plant as a substitute source. However, these economics may change in the future as cost and availability of fuel become more significant than capital investment. Recent developments in energy storage systems may spark renewed interest in wind power. The fact that wind power is not purely an environmentalist's dream is illustrated by the fact that Montana's rural residents for many years supplied their immediate electric needs with home generated DC power from wind.

VI. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND LONG-TERM EFFECTS

VI. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND LONG-TERM EFFECTS

Our society's dependence upon electrical energy is growing rapidly. A form of energy developed in less than a century is now used in so many ways in the domestic, industrial, and commercial sectors of our society that our way of life is dependent upon it. The technological and economic changes this century have been so dependent upon electricity that this form of energy is considered by many as essential to civilization. Others argue that civilizations have existed for many times as long as has electrical energy production and there is little indication that this society is more civilized than ones gone before. Even in existing societies it is contended that there is no relationship between electrical power consumption and degree of civilization.

The rapid growth of electrical energy consumption in the U. S. at this time is an indication of our dependence on this commodity. This "demand" for electrical energy, and many question whether this is a real or artificially stimulated demand, is presently being met largely by the consumption of non-renewable resources: coal, oil, and gas. This "demand" is presently growing in such a manner that consumption doubles roughly every ten years. This kind of growth is referred to as exponential. At this rate of growth, the "demand" in just three decades will be eight times its present value. Because coal is being used to produce much of this energy, the consumption of this non-renewable resource is also growing exponentially. Although there are large quantities of coal still in the earth, there is considerably less than has been expressed by some. Global reserves are estimated to be 5 x 10^{12} tons or a 2300-year supply at current rates of consumption. However, at a growth rate of 4.1% annually (much less than the growth rate of electrical "demand") there is only a 111-year supply. Even if there is actually five times as much coal as estimated, the supply is only 150 years at a growth rate of 4.1%. In addition, the U. S. has about 32% of the world supply but presently consumes 44% of the world production. (Limits to Growth, Meadows, 1972, Universe Books, New York.) Therefore, if the electrical "demand"

continues to grow at its present rate and this growth is met largely by the conversion of coal, the coal reserves in the U. S. will be greatly diminished in a few decades. The coal, once consumed in a power plant, is lost forever. Future uses of the coal, whether to generate power or as a source of chemicals for production of some other commodity, are denied. The future needs of the coal may be more urgent than our present needs for electricity.

The proposed Colstrip generating plant will not consume the reserves in Montana by itself, but it cannot be divorced from the overall energy situation of the country. (The expressed purpose of the plant makes this point clear.) At present, coal is being removed from the area for power production outside of the Fort Union Region and more power plants are being planned within the Region.

Depletion of coal as a resource is not the only long term consideration involved here. An economy based on the exploitation of the coal is developed in the coal fields themselves, as well as where the electrical energy is being consumed. The short term gains to the Colstrip area are made known by the interests involved in building the plant and mining the coal. Jobs are created and money enters the local economy from these jobs. As long as the coal is mined and the power is generated, the flow of money through the community is assured. When the coal is exhausted, or its use for production of electricity becomes obsolete, the economy and way of life dependent upon the exploitation of the coal will suffer. Many feel that this consequence is inevitable; that only its magnitude and timing are in question. Improper reclamation of the land may destroy the original economic base of the region: the land used for agriculture. Numerous examples of boom and bust cycles can be cited. There is little evidence that this sort of thing will not happen in the Fort Union Region.

At the other end of the transmission lines, is a society and economy becoming more and more dependent upon electricity. Not only is the per capita use of electrical energy increasing, but the number of persons kept employed, warmed, and fed by this energy is increasing. Each ton of coal that is used to meet the increased "demand" of electrical energy is increasing the entire society's economic and physical dependence

upon electricity. A civil disturbance or war or other sudden interruption of the supply of electricity would be catastrophic. Likewise, a sharp rise in the cost of electricity would put a strain on the economy through businesses, manufacturing, and domestic use. This situation is true today but will be more critical as time goes by and our society becomes more and more dependent upon this energy.

The possible local destruction and regional degradation of the ecosystem by the proposed Colstrip plant also has long term implications. Land use changes adversely affecting food production, modification or loss of recreational areas for present and future generations, and changes in natural species may be more significant to our descendants than our use of electricity over the next several decades. Residents of the area will be subjected to changes in social and psychological pressures from this industrial economy and life style, as the change is made from an agricultural base to a more industrial one. Future residents may encounter the reverse situation; that is, adapting to an agrarian life style should the industrial form be removed or altered.

On the more positive side, one can speculate that both short term uses and long term uses will be beneficial. The short term, while the coal supply lasts and through the life of plant operation, will see increased employment in the Colstrip and Fort Union area, and at the receiving end of the electricity. The tax base for the communities will also increase. Over a longer period, the increased employment resulting from the short term energy use may continue indefinitely, even though coal is no longer available for power generation. Alternate energy sources will probably emerge as economics dictate their practicality. It is even possible, although not probable, that some of these sources may locate in the Colstrip-Fort Union Region, where water supply and transmission systems will already exist. On reclamation of strip mined land, and possibly obsolete power plant sites, it would appear that society's increasing environmental concern will move to disallow any but the most advanced reclamation methods for the time. It is not inconcievable that reclaimed land can be returned to its former levels of productivity. Still on the positive, it can be argued that man continues to accept new challenges as they arise and often prevails,

minimizing negative consequences. Few dispute that electricity benefits society, and that a major reduction in per capita energy available would be detrimental. Evaluation of these and other potential consequences, be they boon or bone, is nearly impossible. The factual information necessary to make such determinations is, at best, scarce and few people are willing to make judgments of the relative desirabilities of such alternatives for the future.

The relationship between the short term effects and long term effects is one of space and time. It is so much easier to plan for the short term than for the long term. The effects that occur in the long term are seldom planned or taken into consideration in planning. The long term effects, both good and bad, of the Colstrip plant will be accidents, in that they are not planned. One's concern is greatest for things and persons closest to him in space and time. As situations are removed in time (future) or involve a larger portion of the world, a person spends less time and energy thinking about them. For instance, a person is much more concerned with his family over the next few years than with the nation over the next hundred years. (Limits to Growth, op.cit.) Actions based upon these different levels of concern are often contradictory. It is also much easier to accept decisions that have more personal and quicker results than ones less personal and farther removed in time. It is therefore, easier to decide in favor of a power plant that will prevent a small power shortage in one's own town in four years than to be concerned with the fate of a large portion of the United States society fifty years from now. Even though some very serious problems for mankind seem to loom in the future if he continues on his present course, he is reluctant to give up his immediate comforts. This concept is well illustrated by our attitude towards energy in this society. When evaluated at some future date, the proposed Colstrip plant may prove to have been very efficient at solving one immediate problem, but in doing so having created other problems of much greater scope and duration.

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF NATURAL AND ECONOMIC RESOURCES

VII. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF NATURAL AND ECONOMIC RESOURCES

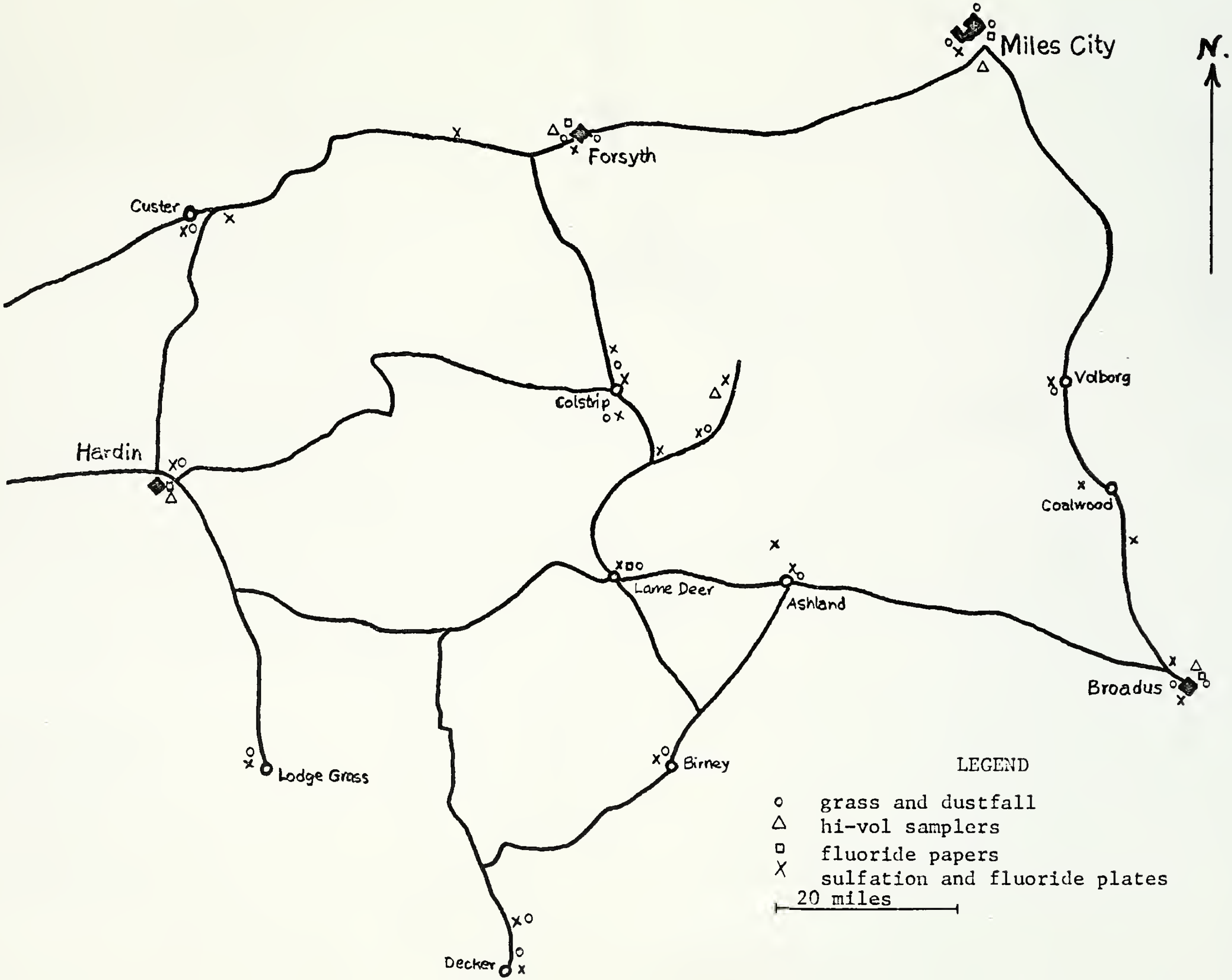
The consumption of a non-renewable resource is an irreversible commitment. The burning of coal in the proposed power plant would be the major consumption of a non-renewable resource. Approximately 90 million tons will be burned in 30 years which represents the coal under nearly 2000 acres if present mining methods are used.

Since this coal will be mined by stripping, 2000 acres of land will be disturbed which will put it out of production at least temporarily. If adequate reclamation is not practiced, the 2000 acres of land will be permanently degraded. Undiscovered archeological material in the 2000 acres will be lost forever.

There are also some of the materials that will be used in the construction of the plant itself plus the aqueduct and transmission lines. Metals and other materials that can be recycled do not fall into this category.

APPENDIX

STATE DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES SOUTHEASTERN MONTANA AIR SAMPLING NETWORK

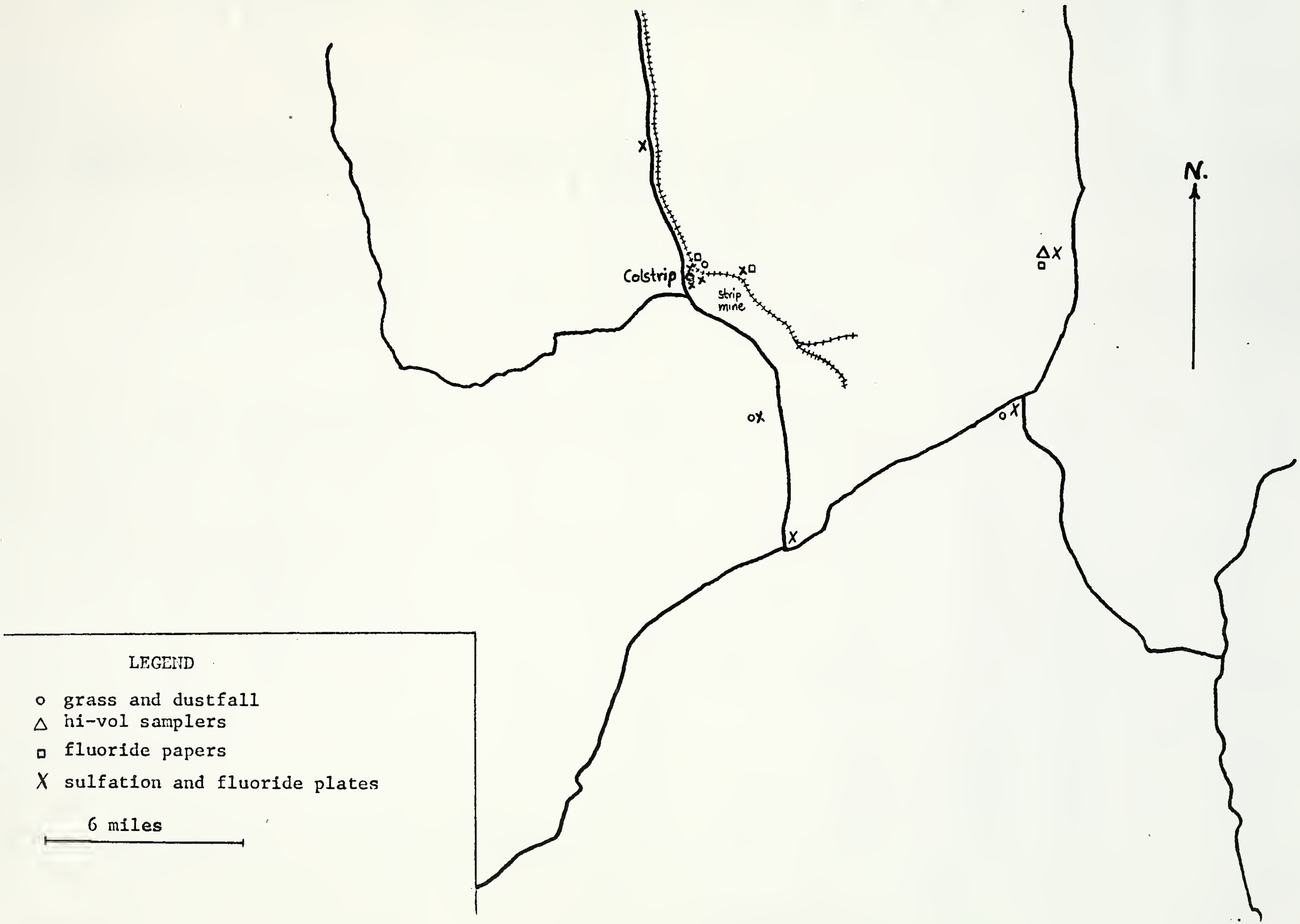


LEGEND

- o grass and dustfall
- △ hi-vol samplers
- ▫ fluoride papers
- X sulfation and fluoride plates

20 miles

STATE DEPARTMENT OF HEALTH AND ENVIRONMENTAL SCIENCES COLSTRIP AIR SAMPLING NETWORK



SAMPLING RESULTS

*(mgSO$_3$/100cm^2/day) .035 = ppm	SULFATION PLATES		F^- PLATES		F^- PAPERS		GRASS							DUSTFALLS						HI-VOLS	
	# Samples	Conc. PPM* $\bar{X}$	# Samples	Conc. $\bar{X}$ ug/cm^2/ 30 days	# Samples	Conc. $\bar{X}$ ug/cm^2/ 30 days	# Samples	Conc. $\bar{X}$ PPM F^-	# Samples	Conc. PPM $\bar{X}$ As	Pb	Cd	Zn	# Samples	Conc. $\bar{X}$ T/mi^2/mo.	# Samples	Pounds per square miles/mo. Cd	Zn	Pb	# Samples	Conc. $\bar{X}$ ug/m^3
COLSTRIP																					
Approx. 5 miles N.	6	.0021	2	0.00																	
Water Tower Pumphouse	7	.0045	3	0.05	5	.060	3	3.2	1	0.0	11.0	0.2	33.0	4	8.6	1	0	12.0	3.6		
Western E. Office	8	.0049	4	0.00																	
Warehouse	7	.0021	4	0.00																	
Approx. 1½ miles E.	5	.0014			5	.044															
Approx. 9 miles S.	8	.0014	4	0.00																	
Kluver Ranch (9 miles E.)	5	.0024	3	0.00	5	.011														23	22.0
Peabody E.	4	.0017	4	0.00			3	5.9	1	0.2	8.0	0.4	25.0	4	9.6	1	.22	16.0	5.2		
Approx. 8 miles SE	4	.0024	4	0.00			3	2.7	1	1.1	6.0	0.3	19.0	3	28.6	1	.22	16.0	4.4		
NO. OF COLSTRIP																					
Forsyth																					
West	5	.0045	4	0.00			3	2.2	1	1.9	20.0	0.6	58.0	4	17.0	1	.08	24.0	15.8		
East	5	.0028	4	0.00			3	11.0	1	2.2	67.0	1.2	55.0	4	19.6	1	.26	24.0	13.2		
Deport	4	.0028	2	0.00																	
Greson Res.	5	.0028			5	.045														23	68.6
Interstate Marker 507	1	.0031																			
N.E. OF COLSTRIP																					
Miles City																					
Fish & Game	5	.0028	4	0.03			3	7.0	1	1.6	15.0	1.0	43.0	4	22.1	1	.22	58.0	12.2		
East	5	.0031			4	.016	3	3.3	1	1.1	15.0	0.7	25.0	4	25.9	1	.36	48.0	20.0		
Asay Res.	5	.0031	4	0.00			1	4.0						2	28.8					70	71.5
Gravel Pit N.	4	.0024	3	0.00																	
EAST OF COLSTRIP																					
Volburg	5	.0021	4	0.00			3	2.9	1	0.6	11.0	0.5	26.0	4	7.2	1	.08	10.0	6.6		
Coalwood	5	.0024	4	0.00																	
Ash Creek	5	.0021																			
S.E. OF COLSTRIP																					
Broadus																					
East	4	.0035	4	0.06			3	7.9	1	1.4	9.0	0.3	27.0	4	43.1	1	.32	142.0	24.0		
West	4	.0042	3	0.00			3	9.2	1	1.9	15.0	1.0	34.0	4	47.2	1	.22	26.0	9.6		
LaFlamme Res.	4	.0028			3	.023														12	39.7
Sewage Lagoon	4	.0059	2	0.00																	
U. S. Junction 312 & 212	5	.0024																			
Ashland																					
Power Substa.	4	.0024	4	0.03			3	5.2	1	0.3	7.0	0.7	17.0	3	12.0	1	.04	48.0	2.2		
East	5	.0024	4	0.00																	
St. Labrie Mission	4	.0024																			
North	5	.0028	4	0.03																	
S. OF COLSTRIP																					
Lame Deer																					
L.D.S. Church	4	.0017																			
North	5	.0028	3	0.03																	
West	5	.0017	3	0.00																	
East	3	.0017	2	0.00	5	.033	2	6.4	1	0.0	10.0	0.2	30.0	4	10.7	1	.22	22.0	7.8		
Birney																					
Southwest	3	.0028	4	0.00																	
Northeast	4	.0024	4	0.00			3	2.6	1	0.0	5.0	0.2	19.0	3	9.5	1	.02	10.0	4.2		
Decker																					
Decker to Birney Rd.	3	.0014	3	0.05																	
Coal Co.	4	.0024	4	0.00			3	3.5	1	0.3	7.0	0.3	25.0	3	24.4						
Post Office	4	.0035	3	0.00			3	3.2	1	0.0	5.0	0.5	28.0	2	19.6						
S.W. OF COLSTRIP																					
Lodge Grass																					
West	4	.0017	4	0.10																	
East	4	.0017	4	0.00			3	10.7	1	0.0	13.0	0.7	35	2	26.1						
W. OF COLSTRIP																					
Hardin																					
West	4	.0038	4	0.08																	
MDU Sts.	4	.0045			4	.038														18	58.4
East	4	.0038																			
Radio Tower	4	.0038	4	0.04			3	4.2	1	0.0	4.0	1.8	32	2	9.8						
N.W. OF COLSTRIP																					
Custer																					
West	4	.0056	4	0.04			3	3.5	1	0.0	16.0	0.7	34.0	4	8.6	1	.22	18.0	10.6		
Prairie Bar & Cafe	5	.0045	4	0.03																	

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